1-1968

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Published in *The Progressive Fish-Culturist*, Vol. 30, Issue 1 (January 1968) at doi: 10.1577/1548-8640(1968)30[29:ITAAFD]2.0.CO;2

ISOBORNYL THIOCYANOACETATE AS A FISH DRUGGING AGENT AND SELECTIVE TOXIN

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ISOBORNYL THIOCYANOACETATE is an insecticide that is used primarily as a household spray. It is manufactured and sold under the trade name "Thanite" by Hercules Powder Company. Thanite, 82 percent isobornyl thiocyanoacetate and 18 percent other active terpenes, is a liquid which is not soluble in water but is readily emulsified by following the manufacturer's recommendation of 70 percent Thanite to 20 percent kerosene and 10 percent Atlox (a commercial emulsifier).

In screening possible fish repellants, Dr. Robert Summerfelt called my attention to the anesthetizing effect of Thanite on fishes. Subsequently, a series of tests was conducted to determine the lethal minimum concentration for representative fishes and the application for selective kill, total kill, and live removal of various fishes under field conditions.

Procedures

Lethal minimum values were determined in 20-liter glass aquaria at a temperature of 20° to 23° C. Five to seven fish were used in each aquaria. (Table 1 lists the species used.) A spread of concentrations was applied to the aquaria. Survival at 24, 48, 72, and 96 hours was recorded. Mortality did not increase beyond the 24-hour period; hence lethal minimum values were selected on basis of concentrations giving 100 percent mortality in 24 hours. The separation between high survival and 100 percent mortality was clear-cut. The number of rainbow trout available was limited; hence it was possible only to establish if a differential existed between its sensitivity and that of centrarchids.

Field tests involved the treatment of ponds with various concentrations of isobornyl thiocyanoacetate, recording the kill of each species, and subsequently draining or poisoning the ponds to determine the numbers of each species that had survived the experimental treatment. To evaluate the possibility of live recovery of fish after the use of isobornyl thiocyanoacetate, fish were moved to fresh water when they became incapacitated at the surface.

Results

Isobornyl thiocyanoacetate appears to be an effective fish toxin. Further, from the lethal minimum values (table 1), it is evident that the centrarchids, represented by the bluegill and green sunfish, and

TABLE 1.--The 24-hour lethal minimum of isobornyl thiocyanoacetate for representative fishes

Species	Total length (inches)	Concentration (p.p.m.)
Bluegill----------	1.5 to 2.0	0.4
Green sunfish-----	2.0 to 2.5	.6
Rainbow trout[1]----	10.0 to 11.0	<.7
Golden shiner-----	3.5 to 4.0	1.5
Channel catfish---	3.0 to 4.5	1.5
Black bullhead----	2.5 to 3.5	>1.5

[1]At 11° C.

TABLE 2.--Selective kill of fishes by use of isobornyl thiocyanoacetate under field conditions

Pond	Area (acres)	Average depth (feet)	Water temperature (°F.)	Concentration (p.p.m.)	Species	Number killed by test chemical	Number obtained by poisoning or draining
Pond 20, Fountain Bluff---	0.1	4.0	87	0.7	Green sunfish------	17	1
					Largemouth bass----	11	0
					Black bullhead-----	1	5
					Golden shiner------	0	Numerous
					Mosquitofish-------	0	Numerous
					Tadpoles-----------	0	Numerous
					Crayfish-----------	0	Numerous
Pond 21, Fountain Bluff---	.1	4.0	50	.8	Bluegill-----------	6	0
					Largemouth bass----	4	0
					Channel catfish----	0	1
					Golden shiner------	Few	>500
					Mosquitofish-------	Numerous	Numerous
Pond 1, Moroni's---	.3	4.5	68	1.5	Green sunfish------	Numerous	0
					Largemouth bass----	[1]70	0
					Channel catfish----	3	11
Brown's Pond-------	.34	3.4	58	.8	Green sunfish------	Numerous	0
					Golden shiner------	<100	Numerous
Moroni's Bass Pond----------	4.5	3.5	50	1.5	Redear sunfish-----	Numerous	0
					Largemouth bass----	[1]121	0
					Channel catfish----	7	12
					Golden shiner------	Few	Numerous
Pierce Pond--------	.6	3.0	80	1.5	Largemouth bass----	2	0
					White crappie------	Numerous	0
					Black bullhead-----	Numerous	Numerous

[1]Bass were removed when they became incapacitated at the surface. Size, 0.25 to 4.5 pounds.

apparently the rainbow trout are two to three times more sensitive to the toxin than the cyprinids and ictalurids.

It is obvious from table 2 that the differential effect of isobornyl thiocyanoacetate observed in the laboratory was observable under field conditions. Thus, centrarchids were selectively killed in the presence of ictalurids and cyprinids. The live removal of adult largemouth bass from treated ponds was highly successful.

Discussion

Isobornyl thiocyanoacetate offers the fishery biologist some interesting possibilities. It can be used for live removal of adult bass and probably other adult sunfishes. In this respect it is similar to sodium cyanide (Bridges, 1958; Lewis and Tarrant, 1960), but it is not so dangerous to handle as cyanide. Also, isobornyl thiocyanoacetate shows a selective action. Since the sensitivity of centrarchids is considerably greater than that of cyprinids and ictalurids, it is possible to remove sunfish selectively in the presence of minnows, at least under the conditions of the present investigation.

The cost of treatment, especially for selective kill and live capture of centrarchids, compares favorably to the cost of rotenone treatment. Isobornyl thiocyanoacetate has not been approved by the U.S. Food and Drug Administration for the use suggested here, and it is probable that such use will be confined to experimental work. Mr. Harry Leland (unpublished) found that the blood of fishes killed by isobornyl thiocyanoacetate contained cyanide concentrations which were similar to levels occurring in fishes killed with sodium cyanide. Subsequently, however, Leland demonstrated a rapid loss of cyanide from the blood of fishes held in fresh water.[1]

Literature Cited

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[1]Leland, Harry V.: Loss of cyanide from water, soil, and fishes when sodium cyanide is used as a fish poison. Master's thesis, Southern Illinois University, 1964. Morris Library, Southern Illinois University, Carbondale, Illinois, 25 p.

The stocking of striped bass has been considered a likely solution to the problem of controlling the gizzard shad in reservoirs in the southern half of the United States. Unfortunately, striped bass fry that have been stocked directly into reservoirs have not developed a population sufficient to cope with the shad, and fishery workers have had difficulty in rearing the striped bass to fingerling size, as well as in handling and transporting the fish.

A hybrid (white bass male X striped bass female) first produced in 1965 by the State fish hatchery at Moncks Corner, South Carolina, may prove to have greater potential for controlling the shad and producing a sport fish catch than its female parent. Progeny of this original cross, stocked in Cherokee Lake, Tennessee, as fry and fingerlings, are now being taken regularly by fishermen.

A 14.5-pound fish taken from Kentucky Lake, identified as a hybrid (white bass female X striped bass male), indicates that maximum hybrid weights will far surpass the white bass.